Sempervirens
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UR's Witness Oak project honors enslaved ancestors

Article and images by W. John Hayden, Botany Chair

It is an inescapable fact of history that the institution of slavery was once widespread in Virginia. Indeed, long ago, enslaved persons worked the land on which the University of Richmond campus now exists. The university did not come to occupy its present location in the western suburbs of Richmond until decades after the abolition of slavery. But graves of enslaved people near the center of campus provide compelling testimony to the history of the place where I have worked for the past four decades.

Recently, an effort has emerged on campus to commemorate the graves of these enslaved persons as the Burying Ground Memorial. The site, located on the south side of Fountain Hall, will be garden-like and, consequently, careful assessment was made of existing trees in the surrounding area. One tree in particular, a White Oak (*Quercus alba*) (Figure 1), was judged to be old enough to have been present at the time the interments took place. As such, this tree has come to be known as the Witness Oak.

When plants at the Burying Ground were initially assessed, the canopy of the Witness Oak included several dead limbs (Figure 1). Despite this sign of age-related decline, a decision was made to try and keep the Witness Oak as part of the memorial garden. However, in case the tree should happen to decline further, it was judged prudent to attempt the production of seedlings from its fall 2023 crop of acorns so that, if necessary, genetically related replacement saplings would be at hand.

Figure 1. The White Oak Witness Tree near Fountain Hall on the University of Richmond campus; graves of formerly enslaved persons are located to the left front of the Witness Tree; note dead canopy limbs at top, center.

Accordingly, under direction of Allison Moyer, Associate Director of Landscape Services and Horticulture, a total of about 900 acorns (Figure 2) were gathered and delivered, in three batches, to the Department of Biology Greenhouse for germination. As the biology faculty member with responsibility for maintaining the greenhouse, the task of producing Witness Oak seedlings fell to me and my able crew of student assistants: Gloria Kroodsma, Alexandra Stellwagen, Alex Duguid, Emily Matthews, and Laneah Gordon.

Because not all acorns that fall to the ground are viable, our first step was to do a floatation test; potentially viable acorns sink, non-viable acorns float. Only a small portion of the acorns floated, and the floaters were thrown out. The remainder were planted in soil, 96 acorns per shallow tray, and the trays were placed on benches in the greenhouse.

The expected germination process for White Oak was that acorns would first produce a root while weather was still warm in the fall (Figure 2), but nothing more than this first root was expected through winter. Then, in spring, it was expected that shoot systems, i.e., stems and leaves, would emerge from the acorns, thus establishing new plants ready for their first year of growth. To our surprise, however, about 200 acorns produced roots and shoots by mid-November 2023! Improvising on-the-fly, these 200 seedlings were removed from their shallow germination trays and placed in tall-form tree pots. Tall-form pots accommodate well the tap root that acorns make in their first few years of growth.

(See White Oak Witness Tree, page 2)

White Oak Witness Tree seedlings

(Continued from page 1)

To replicate natural winter conditions for these Witness Oak seedlings, at the end of the fall semester we moved the 200 tall-form pots to an outdoor raised bed in the on-campus community garden (a.k.a. Abby's Garden). Some soil was temporarily removed from one raised bed so that the pots and emergent seedlings would not project above the sides of the bed. Because the acorns still had considerable nutritive value, and might thus be tempting to hungry squirrels, the bed was covered with one-quarter inch hardware cloth. To minimize temperature fluctuations during winter, a light covering of leaves was placed over the hardware cloth—in retrospect, I judge this step to have been not necessary, at least not for the 2023-2024 winter season.

In early March of 2024, the pots were removed from the raised bed and placed, in a group, adjacent to the garden fence. Whereas overwintering tree seedlings required no maintenance effort, young trees, in pots, in spring, require regular attention.

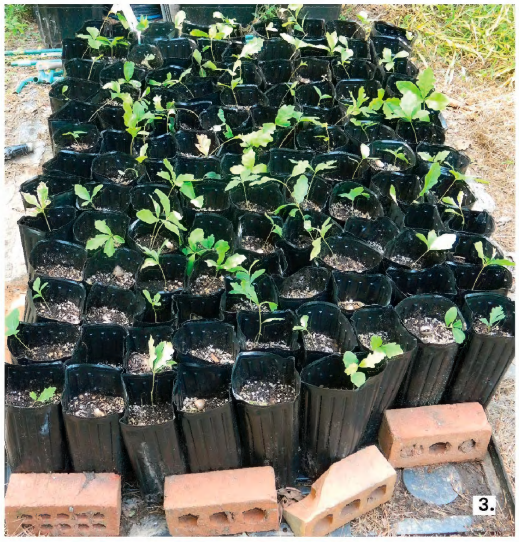

Figure 3. White Oak Witness Tree seedlings, growing well in Powhatan County, Va.

It became apparent that the Community Garden location, some distance from my office and lab, was not conducive to regular watering and general oversight/care. Consequently, I decided to move the seedlings to my residence in Powhatan County (Figure 3). At the time of this move there were approximately 100 healthy, living, seedlings and five and a half months later, all are doing fine.

Most recently, as students have returned to campus for the fall 2024 semester, we have been able to pot up another 60 seedlings that produced emergent shoot systems over the summer. These, too, will be moved to my back yard for the upcoming winter season.

Already, three Witness Oak seedlings have been taken by Allison Moyer for incorporation into the landscaping around Boatwright Library, part of which is currently undergoing renovation. There should be plenty of seedlings to incorporate in the Burying Ground Memorial when the careful and respectful process of renovating that area reaches the point of installing new plant materials. And, as institutions do, the University of Richmond has a schedule for future building renovations, a process that always incorporates new landscaping—for which we now have a good supply of Witness Oak progeny.

This article is about one tree and one cemetery plot.

Figure 2. Acorns from the White Oak Witness Tree, November 3, 2023; notice emerging radicles on several acorns.

Though the existence of some may have been forgotten, many more burial grounds for the enslaved are known and some of these may still have trees old enough to have "witnessed" the interments of those who toiled so hard, for so long. What better way to remember their contributions to the land that continues to nourish us than by maintaining a living legacy of Witness Tree progeny? ❖

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Next submission deadline:
Nov. 1, 2024

Introducing our newest Society board members

From the President Nancy Vehrs

Greetings from your "President for Life!" At our annual meeting last month, I was elected to an unprecedented fifth term. During this term, I will work diligently to find a successor because this is *not* a life position. There are many of you out there capable of this position, and I am determined to find you.

With terms beginning in November, we welcome the following new members to our board of directors:

- **Jennifer Crawford**, Secretary. Jen is a lover of the outdoors with a strong penchant for teaching. Widely trained as a Virginia and Florida Master Naturalist, Virginia Master Gardener, Arlington Tree Steward, and with a Certificate of Accomplishment in Natural History at Nature Forward, Jen is passionate about continuously adding to her nature knowledge. She worked as a nature interpreter at Huntley Meadows Park for three years. Technically retired, her work history includes service as a career officer in Army Intelligence, followed by 10 years as an elementary school teacher.

- **Maeve Coker**, Education Chair. Maeve earned her bachelors in fisheries and wildlife biology from California University of Pennsylvania in 2014. She spent several years working with nesting shorebirds for The Nature Conservancy on the Virginia Barrier Islands, and she currently works as a Biological Technician at the Eastern Virginia Rivers National Wildlife Refuge Complex. She is a life member of the VNPS-Northern Neck Chapter and is an avid volunteer on the Middle Peninsula and Northern Neck for a variety of citizen science surveys. She serves as the Citizen Science Chair for Friends of Dragon Run. Maeve spends her free time birding and botanizing. She lives in Essex County with her husband Joey and their rescue hounds, Gypsy and Daisy.

- **Aaron Kershaw**, Director-at-large. Aaron is a marketing and communications professional who has utilized his skills and expertise to passionately advocate for the protection of nature. He has extensive experience as a marketing and communications director and has worked as a journalist, freelance writer, and freelance marketing strategist for environmental organizations. From 2020-2024, Aaron worked for the Northern Virginia Conservation Trust, where he developed effective marketing strategies that led to record-breaking fundraising campaigns and increased the organization's brand awareness and support. He recently accepted a position as Communications Manager at LegacyWorks Group. A Virginia native now living in Washington, D.C., Aaron is committed to protecting nature and maintaining healthy, livable communities.

- **David Gorsline**, Technology. David is a recently retired software engineer and a Fairfax Master Naturalist. A member of VNPS since 2016, he handles membership duties for the Potowmack Chapter. He is an eager team member for many nonnative invasive management projects across Northern Virginia. He serves as a leader/participant on a Christmas Bird Count and various butterfly surveys, odonate counts, and bioblitzes. David built applications for the web for three decades. He has wrangled HTML for community theater websites; co-wrote a blogging tool for radio journalists; and edits scientists' biographies for Wikipedia. David lives in Reston; he holds a degree in mathematics and economics from Northwestern University and an MBA from the University of Pennsylvania

I am grateful to returning board members Botany Chair John Hayden and Fundraiser Chair Emilia Godwin. We thank outgoing board members Anna Finch, Joey Thompson, Kathleen O'Shea, and Joe Villari for their service to VNPS and its members.

As the annual meeting at Massanetta Springs becomes but a memory, I thank those who helped plan and execute the event: Sally Anderson, Kevin Howe, Karen and Robin York, Anna Finch, Melissa Korzuch, Anna Maria Johnson, Lora Steiner, and Brigitte Harke. I also thank our excellent speakers Andrea Weeks and Iara Lacher and all our field trip leaders. ❖

Annual Meeting Field Trip Highlights

Cowbane walk showcases prairie flora

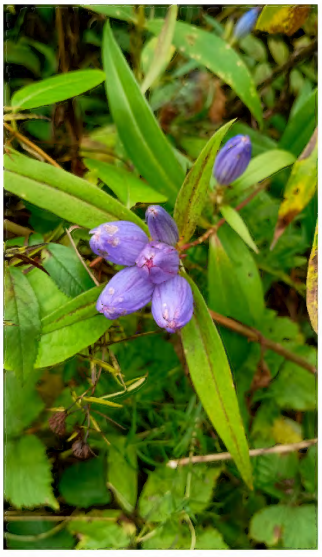
We visited Cowbane Prairie on Sunday, Sept. 22, enjoying pleasant weather that started off with a few drizzles but soon got warm and humid.

On the short walk to the prairie patch, we stopped frequently to admire the various riparian vegetation along the ditch leading to the field. The trees in this area consisted of Black Willow, Blackhaw Viburnum, Silky Dogwood, Eastern Redcedar, Boxelder, Eastern Cottonwood, Black Cherry, and Persimmon. There were also several Green Ash trees, some of which had been treated to protect from Emerald Ash Borer, while others were in varying states of decline from the pest. The landowners had been attempting to control invasive shrubs in the riparian area with herbicides, which appeared to be moderately successful.

The Cowbane Prairie landscape. (Jack Monsted photos)

The wetland itself was a vibrant display of color – all yellow, white, and purple from various goldenrods, asters, and ironweed. Immediately notable species included Tall Goldenrod (*Solidago altissima*), New York Ironweed (*Vernonia noveboracencis*), New England Aster (*Symphyotrichum novae-angliae*), Swamp Thistle (*Cirsium muticum*), Boneset (*Eupatorium perfoliatum*) and the always lovely Sneezeweed (*Helenium autumnale*).

As we explored deeper into the space, we came across many other plants that had just finished flowering including Queen of the Prairie (*Filipendula rubra*), a state rare plant whose foliage was beginning to turn a lovely shade of red. Rose Mallow (*Hibiscus moscheutos*), Swamp Milkweed (*Asclepias incarnata*), and Wild Senna (*Senna hebecarpa*) were also in varying stages of setting seed. Further on, we were dismayed to see that part of the population of Rattlesnake Master (*Eryngium yuccifolium*) and Bottle Gentian (*Gentiana clausa*) were recently mowed along the fenceline of the property. Fortunately, we pressed on and found many of them still thriving in the back of the prairie patch. While the Rattlesnake Master was going to seed, the Bottle Gentians were still in full bloom and put on quite the show for us.



Bottle Gentian (left) and Swamp Thistle

Finally, on our way out, a group of us waded through the marshy interior of the wetland to get a closer view of a large stand of Northern Blue Flag Iris (*Iris versicolor*). While there, we also noticed a good clump of Swamp Rose (*Rosa palustris*) and the plant for which the prairie was named, Cowbane (*Oxypolis rigidior*).

Nate Miller did an excellent job guiding us through the space and offered a wealth of information on the history and management of the area, in addition to his excellent plant ID skills. I recorded 62 species of plants on our walk, though I'm sure there were many more in this remarkably diverse wetland.

--Jack Monsted, Assistant Curator, Native Plant Trail, State Arboretum of Virginia

Oak Hickory Trail explored at JMU Arboretum

The 2024 VNPS Annual Meeting fieldtrip to the Edith J. Carrier Arboretum at James Madison University (JMU) was enjoyed by an enthusiastic group of VNPS participants on Saturday afternoon, Sept. 21. This fieldtrip was led by Keala Timbo, a knowledgeable Master Gardener volunteer. Keala began the walk, which was focused on the Oak Hickory Trail, by sharing some examples of the over 500 insect interactions with oak tree species including showing egg cases of some insect species.

Keala Timbo

During the walk she pointed out native species of spring-blooming herbaceous plants such as wild ginger, shrubs such as rhododendron and azalea species, and species of oaks and hickories. In addition, she discussed the ecological relationships of species within this ecosystem. The Edith J. Carrier Arboretum, established in 1989, covers 125 acres of the JMU campus. Oak and Hickory trees, the oldest of which may date back to the early 20th century, occupy 87 acres of the 125. There are some three miles of trails through the arboretum. Due to time constraints, only a portion of the Oak Hickory Trail was explored by the group and Keala encouraged participants to return to explore other trails and specialty gardens of the Arboretum. Special thanks goes to Keala for this informative field trip.

Annual Meeting participants explore the Oak Hickory Trail at JMU's Edith J. Carrier Arboretum. (Dave Timbo photo)

--Marion Lobstein, PWWS Botany Chair

Sunnyside moving toward more natives on the grounds

Our Sunday morning field trip was to Sunnyside. a retirement community near Massanetta Springs conference center in Rockingham County. Our resident guides, Nat and Gail, are on the Sunnyside Green Committee and are master gardeners with an interest in shifting the landscape at Sunnyside toward native plants. First stop was an area around a retention wall in a "bowl" that receives rain runoff from a parking lot and then becomes quite dry between storms. Vibernum, Buttonbush, Redbud, and Magnolia were among the natives that we encountered. Natives planted closer to an existing Walnut tree have extra challenges. This area served as a test site for how Green Committee projects would turn out.

VNPSers learn about the cultivated landscape at Sunnyside. (Mary Rhoades photo)

Residents at Sunnyside have control over the plantings around their houses but the majority of the landscaping is done by Sunnyside. The Green Committee has been able to lend suggestions to management for further projects. However, the committee is also careful not to overextend so they can keep the areas looking professional and appealing.

Our second stop was the Cobb Garden fronting a one-story building that is being renovated for common uses. Built on a slope, the front approach was replaced with a low wall approximately 4 x 30 feet. This created a bed that was filled with soil and planted with a mixture of native and non-native flowering plants. Oriental Lilies were present alongside Cosmos, Tithonia, Zinnia, Heuchera, and Liatris, creating a stunning palette of fall colors

The path to stop 3 (Gail's house) wound upward through a forest path. Gail is an active member of the Bluebird Society and the Community Collaborative Rain, Hail, and Snow Network. She has a beautiful mixture of natives and nonnatives such as Coral Honeysuckle, Moonflower, Catmint, again mixed with an appealing array of flowering and succulent plants. The yard is attracting pollinators.

We finally viewed Nat's yard, which he is shifting toward natives away from landscape plants we commonly see. He has the largest yard in the facility and is able to use bushes, small trees such as Winterberry and Serviceberry, with an eye toward feeding the birds.

Nat and Gail exemplify engaged gardeners working toward a more native landscape. They are diplomats able to see and balance institutional interests with the emerging paradigm of going native.

--Dean Troyer, South Hampton Roads Chapter

Reddish Knob rich in high elevation diversity

We drove to the top of Reddish Knob, stopping at several points to botanize along the way. On the way up we noticed several species of goldenrods, including Cutleaf Goldenrod (*Solidago arguta*), and the unique, White-flowered Silverrod (*Solidago bicolor*). We also saw a number of asters, Shining Sumac shrubs (*Rhus copallinum*), Woodland Hydrangea (*Hydrangea arborescens*), and several thriving Dutchman's Pipe vines (*Isotrema macrophylla*) that were loaded with their large, pickle-like fruits.

The view from Reddish Knob. (Jack Monsted photos)

The cloudy, dramatic weather on the top of the knob provided a perfect backdrop to admire the shrubby vegetation unique to high-elevation areas, such as the Fire Cherry (*Prunus pensylvanica*), Bear Oak (*Quercus illicifolia*), Striped Maple (*Acer pensylvanicum*), and some beautiful American Mountain-ash that were in full fruit (*Sorbus americana*). Other woody plants on the knob included Elderberry (*Sambucus canadensis*), a resprouting American Chestnut (*Castanea dentata*) and many flowering Witch-hazels (*Hamamelis virginiana*). Herbaceous vegetation included Hay-scented Ferns (*Dennstaedtia punctilobula*), Whorled Wood Aster (*Oclemena acuminata*), and a number of other small asters (*Symphyotrichum* spp.).

Shining Sumac

On the way down we stopped on a side road to explore a few clearings and forested roadsides, drawn in initially by a massive Virgin's Bower (*Clematis virginiana*) that was covering an old fallen log and bearing an abundance of its unique, spindly seed pods. We walked down the road for a while in search of a special disjunct southern population of Balsam Fir (*Abies balsamea*), unique in Virginia because the majority of this tree's range is in New England and Canada. The firs eluded us, but other plants in this area included Mountain Fetterbush (*Pieris floribunda*), Flowering Raspberry (*Rubus odoratus*), Richweed (*Collinsonia canadensis*), Wild Strawberries (*Fragaria virginiana*), Blue Wood Aster (*Symphyotrichum cordifolium*), Black Cohosh (*Actaea racemosa*), and Wreath Goldenrod (*Solidago caesia*). We also found several ferns including Rock Polypody (*Polypodium virginianum*), Ebony Spleenwort (*Asplenium platyneuron*), Christmas Fern (*Polystichum acrostichoides*), and Marginal Wood Fern (*Dryopteris marginalis*).

Overall, it was a great outing! I recorded 45 species of plants, but I'm sure we saw many more. Big thank you to Conley McMullen for leading the group and sharing his extensive botanical knowledge of the area.

--Jack Monsted, Assistant Curator, Native Plant Trail, State Arboretum of Virginia

A large Virgin's Bower lured the VNPSers closer.

What's in a name? A lot it turns out.

For those of you who geek out on both native plants and the beauty of words, then you must spend some time on the VNPS website and dive into *Virginia Plant Names: Latin and Greek Meanings and Derivations: An Annotated Dictionary of Botanical and Biographical Etymology* found on the VNPS website.

Identifications L-R: Yellow lady's slipper (*Cypripedium parviflorum*); Bladder campion (*Silene cucullata*); Fire pin
virginica); Cancer root (*Conopholis americana*); Needle-tip blue-eyed grass (*Sisyrinchium mucronatum*); Eastern
(*Physocarpus opulifolius*); Green and gold (*Chrysogonum virginianum*).
Virginia Plant Names:
Latin and Greek Meanings and Derivations
An Annotated Dictionary of Botanical and Biographical Etymology
Compiled by Michael L. Charters
Enter Here

Although compiler Michael L. Charters takes no original credit for this massive botanical and historical work, he is far too modest. Pulling together into one source the stories of how plants got their names, by explaining both language and historical origins, was certainly a long labor of love for which we should all be grateful. Researching and compiling the incredible biographical details of the many obscure persons who are now immortalized as botanical names or who were instrumental in developing our modern nomenclature took an unthinkable amount of work.

Michael, however, goes even further, offering information on the basic principles of botanical name pronunciation for instance. Finally, although this work, which will be added to and tweaked as new information comes to light, is steeped in scientific jargon, it is also just plain fun to read.

Here are a few examples, from A to Z with a few in between, to wet your whistle:

- **Acaly'pha:** from the Greek **akalephes** for "nettle," being an ancient name for a kind of nettle but applied by Linnaeus to this genus because of the nettle-like appearance of the leaves. The genus *Acalypha* was published in 1753 by Carl Linnaeus and is called copperleaf or three-seeded mercury.
- **X faxon'ii:** a hybrid oak species with parents *Q. alba* and *Q. prinoides*, named for Charles Edward Faxon (1846-1918), by botanist Daniel Cady Eaton. In the late 1870s, Eaton asked Faxon and his brothers to make collections for him. Faxon also contributed watercolor illustrations to Eaton's *Ferns of North America*, published in two volumes in 1879 and 1880. From 1879 to 1884 Faxon was employed as a botany instructor at the Bussey Institute, a respected biological institute at Harvard University named for Benjamin Bussey, who in 1835 endowed the establishment of an undergraduate school of agriculture and horticulture and donated land in Jamaica Plain, Massachusetts, that became the Arnold Arboretum
- **heliop'sidis:** from Greek **helios**, "the sun." The ITIS website and other sources give the common name of *Rudbeckia heliopsidis* as sunfacing coneflower, so that provides a clue as to the meaning of this name.
- **Siderox'ylon:** from Greek **sideros**, "iron," and **xylon**, "wood," referring to the hardness of the heartwood. This genus in the family *Sapotaceae* is commonly referred to as bully trees and was published by Carl Linnaeus in 1753.
- **ulmifo'lia:** with leaves like elm, genus *Ulmus*.
- **Zanthoxy'lum:** yellow wood. Stearn says "from the Greek **xanthos**, "yellow," and **xylon**, "wood," for the color of the heartwood in some species." Common names for this genus include Prickly Ash, Hercules' Club, and Toothache Tree. Wikipedia says "It is technically misspelled, as the **'z'** should be **'x'**, but botanical nomenclature does not allow for spelling corrections." It also says "It refers to a yellow dye made from the roots of some species," which may or may not be correct. The genus *Zanthoxylum* was published by Carl Linnaeus in 1753 and is called Prickly-ash or Toothache tree.

--Nancy Sorrells, Sempervirens editor

Heroic measures taken to save rare Pondspice

From Your Natural Heritage Program

By Zach Bradford
Chesapeake Bay
Region Steward

Pondspice (*Litsea aestivalis*) has been documented in only a handful of places in Virginia over the last three centuries yet weaves together threads of Virginia's early history, the birth of biological classification as we know it now, and a tale of tenuous survival.

Pondspice is a globally rare shrub of isolated, seasonally flooded wetlands of the southeast. Like its relative Spicebush (*Lindera benzoin*), Pondspice is dioecious, with male and female flowers on separate plants. Across its range from the Eastern Shore of Maryland to the Florida Panhandle, Pondspice populations tend to be small with few, scattered individuals. NatureServe assesses that Pondspice has undergone a 50-70% long-term decline and that threats include habitat loss, hydrological alterations, fire suppression, and invasive species including feral pigs. Recent research found that Pondspice is susceptible to laurel wilt fungal disease, which is decimating Redbay (*Persea borbonia*) and Swampbay (*P. palustris*) to Virginia's south and will likely reach the Commonwealth in the coming years.

While undoubtedly known to indigenous peoples of the southeast, Pondspice was among the first North American plants introduced to European audiences by *Flora Virginica*, a publication released in two volumes in 1739 and 1743 by Jan Frederick Gronovius. This work was based on specimens collected in the 1730s in southeastern Virginia by Gloucester County clerk of court John Clayton. Clayton's pressed Pondspice specimens included both flowering and leafed-out twigs, events that are naturally separated by at least a month and indicate that the plant was intriguing enough to Clayton to warrant a follow-up visit. Clayton's Virginia specimens eventually made their way to Swedish taxonomist Linneaus, the creator of the species naming system still used today, and in 1753 what we know as Pondspice was given the scientific name of *Laurus aestivalis* – the summer laurel. Despite Virginia being the source of the very specimen from which the species was first described using Linneaus's new method of biological classification and naming, Pondspice has since been documented just five more times in Virginia.

In 1806, Philadelphia physician and all-around naturalist Benjamin Smith Barton hired German botanist Frederick Pursh to lead a botanical expedition through Maryland, Virginia, and the Carolinas. After traveling south along the Appalachian Mountains, Pursh pushed east across Virginia and eventually had an extended stay in Southampton County. It was there where Pursh collected and pressed five twigs of Pondspice. Pursh was an intriguing and tragic character in his own right and his fruitful 1806 southeast botanical expedition was largely overshadowed by the return of Lewis and Clark from their famous exploration of the Louisiana Purchase.

In 1840, German pharmacist Ferdinand Rugel pressed a twig of Pondspice collected "in the marshy woods" near Portsmouth, then a shipbuilding community of just 6,500 residents. For the next 155 years, Pondspice went completely unnoticed in Virginia, and it was presumed lost from our flora until biologists found three individuals in a seasonal depression pond in York County in 1995. Perhaps the most remarkable thing about this 155-year lapse following Rugel's observation is that Harvard botanist Merritt Lyndon Fernald never found it during his extensive southeastern Virginia travels. As editor of *Gray's Manual of Botany*, Fernald spent 14 field seasons, from 1933 to 1946, in southeastern Virginia in hopes of bolstering the manual in its extreme southeast range. In 1939, Fernald made a concerted effort to find

(See Pondspice intervention, page 9)

Harvesting anthers from male Pondspice flowers for transfer of pollen to female individuals located at Grafton Ponds Natural Area Preserve. (Virginia Department of Conservation and Recreation photo)

Pondspice intervention

(Continued from page 8)

Pursh's Pondspice location in Southampton County. Fernald was unsuccessful, but he did take a bit of pleasure in playfully pointing out that in the process, he found Dusty Zenobia (*Zenobia pulverulenta*), a rare shrub that Pursh never noticed.

The York County Pondspice population is now protected in perpetuity as part of Grafton Ponds Natural Area Preserve. Since then, two more populations have been found in Isle of Wight County, with one discovered on Antioch Pines Natural Area Preserve and the other on private property. In the late 1990s, shortly after the population at what is now Grafton Ponds Natural Area Preserve was discovered, the lone male Pondspice died of unknown causes. In the years since, fruiting has not been observed in the two female plants and surveys of suitable habitat in the entire pond complex have yielded no additional individuals. Without intervention, this small population is doomed. At some point the plants would succumb to something, be it disease, treefall, or a wandering beaver.

The Stewardship Section of Virginia's Natural Heritage Program uses a variety of techniques, including prescribed fire, invasive species removal, and canopy thinning to manage and enhance habitat of perilously small, rare plant populations. However, in the case of the two Pondspice at Grafton Ponds Natural Area Preserve, a more direct action was required. This year, DCR's Natural Heritage Program made the unprecedented decision to attempt to rescue the Grafton Ponds Pondspice population by transferring pollen from a donor population about an hour away. The approach was simple: On several days in March, I harvested ripe Pondspice anthers in Isle of Wight County then immediately drove them to Grafton Ponds Natural Area Preserve and dabbed pollen on the stigmas of hundreds of female flowers. A small number of fruits are currently maturing and they will be provided to our conservation partners at the North Carolina Botanical Garden where they will hopefully be grown into seedlings for outplanting with the two mother plants. The goal is for these seedlings, about half of which should be male, to grow to reproductive size and restore natural pollination and fruit production in the population.❖

Male Pondspice flower. (Zach Bradford photo)

Shenandoah Chapter releases revised, updated native plant guide

Virginia Witmer had a vision of publishing regional native plant guides throughout the state.

Anna Maria Johnson wanted our region in particular to have one that focused on plants of the Shenandoah Valley and its adjacent ridges. To do this, she needed to have a sponsoring VNPS chapter to serve as the fiscal agent (a legal 501(c)(3) to ethically manage the funds for printing and sales), so she revitalized the dormant Shenandoah Chapter. Anna Maria not only pulled together an energetic board for the chapter leadership, she also found a team of volunteers to work on her vision of a native plant guide. That dream became a reality in June of 2023 when 2,000 copies were published and sold out in less than a year.

This October, a 2nd edition of 4,000 copies of the *Plant Ridge & Valley Natives* will be published. Much of it will be familiar to those who have been using the 2023 edition, but there will also be some additions and changes that local gardeners should expect to use and enjoy. In response to feedback, we have added a glossary, index of common names, and plant lists for specific gardening challenges such as deer, the presence of Black Walnut, and drought. The new guide runs to 172 pages. Readers will find several additional species of wildflowers, shrubs, and trees, as well as minor edits to the original entries. The pages of invasive species and their native alternatives has been redesigned for better clarity.

Special thanks to partnering organizations who sponsored the printing costs for both editions: Alliance of the Shenandoah Valley, Augusta Bird Club, Augusta Garden Club, Bessie Weller Elementary School, Blue Ridge PRISM, Blue Ridge Wildlife Center, Central Shenandoah Valley Master Gardeners, Edith J. Carrier Arboretum, Friends of the Middle River, Foundation of the State Arboretum of Virginia, Harrisonburg Department of Public Works, Headwaters Master Naturalists, John C. Myers Elementary School, Plains Elementary School, Rockbridge Area Master Gardeners, Rocktown High School, Sustainability Matters, Shenandoah Valley Conservancy, Virginia Department of Forestry, Virginia Museum of Natural History Foundation, statewide Virginia Native Plant Society (VNPS), Piedmont Chapter (VNPS), and Shenandoah Chapter (VNPS).

--Barbara Brothers, Shenandoah Chapter

What do Turtleheads & Cotton have in common?

Article and images by W. John Hayden, Botany Chair

Figure 1. *Chelone glabra*, White Turtlehead

Figure 2. *Gossypium hirsutum*, Cotton

I will not be offended if, dear reader, your response to the question posed in the title is something along the lines of, "Hmmm, probably not very much!" Sure, Turtleheads (Figure 1) and Cotton (Figure 2) are photosynthetic green plants with roots, stems, leaves, flowers, fruits, and seeds, but beyond such basics shared by a few hundred thousand flowering plants, Turtleheads and Cotton are manifestly different. Turtleheads are wild plants native to temperate North America, whereas commercial Cotton plants are domesticated, agricultural, plants derived from species native to the American tropics. Little can be found in their leaves, flowers, fruits, and seeds to argue for any degree of similarity. Taxonomically, these plants are classified in different families: Plantaginaceae for Turtleheads, and Malvaceae for Cotton. Moreover, these two plant families are classified in different orders, Lamiales for Turtleheads, and Malvales for Cotton. Because of their manifest differences and the taxonomic distance from each other, I was surprised to discover a relatively recent scientific paper (Piao et al. 2022) chockful of explicit comparisons between White Turtlehead, *Chelone glabra* (Figure 1), the 2024 VNPS Wildflower of the Year, and commercial Cotton, *Gossypium arboreum* and *G. hirsutum* (Figure 2).

The full title of the Piao et al. (2022) paper is "The R2R3-MYB gene *CgMYB4* is involved in the regulation of cell differentiation and fiber development in the stamens of *Chelone glabra* L." This paper has five coauthors, four of whom are affiliated with an agricultural institute in China. Cotton is agriculturally important; Turtleheads are not. The authors' primary interest is Cotton can be deduced by repeated references in this paper about *Chelone* to other publications focused on cotton. But to me, most revealing of all are the words "fiber development" in the paper's title. Fibers? In Turtlehead stamens? This made no sense, initially, to me. To a plant anatomist, the term "fiber" refers to microscopic elongate cells with thick cell walls, the sorts of cells that make wood hard. Fiber cells are not common in flowers and fiber cells are most certainly not common components of stamens. However, Turtlehead stamens do have one notable characteristic--they are extremely hairy. Both the filaments and anthers are densely covered with soft hair cells (trichomes).

Why would Piao et al. reference *Chelone* trichomes as "fibers?" The answer, I believe, is because they are agronomists focused on Cotton plants and cotton "fibers," the commodity that provides clothes for billions of people around the world, originate as trichomes (hairs) on the surface of Cotton seeds (Figures 3, 4, 5). To farmers, manufacturers, fashion designers, and scientists working with cotton, cotton seed-surface trichomes are simply known as fibers. So, for the special case of Cotton, hairs (trichomes) are called fibers. It is thus not hard to understand that cotton-focused agronomists might refer to the stamen hairs of Turtleheads as fibers.

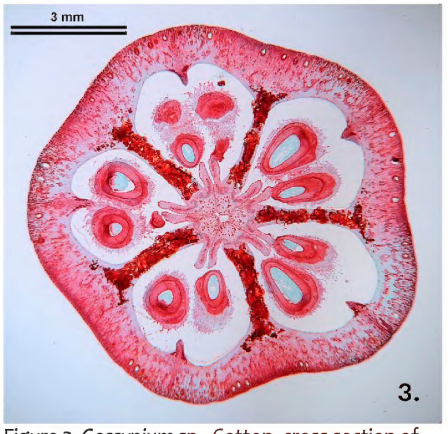


Figure 3. *Gossypium* sp., Cotton, cross section of ovary at flowering stage; 10 ovules are visible in this section.

Figure 4. *Gossypium* sp., Cotton, high magnification of the surface of one ovule shown in Figure 3; at maturity, these trichomes will be about 250 times longer and commonly referred to as fibers.

Figure 5. *Gossypium* sp., Cotton, mature fruit (cotton boll) with hairy seeds.

So, this is what Turtleheads have to do with Cotton: cotton (the commodity) originates as trichomes that arise on seed surfaces of cotton ovules (Figures 3 and 4); gradually, as the cotton boll (fruit) matures (Figure 5), the ovules become seeds and the seed hairs grow to a length of an inch or so long and their cell walls become very thick; at maturity, cotton fibers are long and strong enough that that they can be spun into thread and woven into cloth. Turtlehead stamens, early in development, are hairless but, eventually, trichomes develop on anthers and filaments; Turtlehead trichomes grow profusely up to the time that the flower bud opens for pollination (Figure 6). Simply put, Turtlehead stamens and Cotton ovules do share a common phenomenon, the development of trichomes from surface cells, but this phenomenon takes place on two different organs in these two plants—and the cotton fibers (Figure 5), of course, are much longer and much stronger than the staminal hairs of Turtleheads (Figure 6).

Because of its economic importance, cotton fiber growth and development has been studied thoroughly. As is often the case in biology, fixed focus on a single species is like looking at the world through blinders—widening one's scope of inquiry can open new vistas of understanding. For cotton agronomists, I suspect, the opportunity to study trichome origin in a completely different plant, unrelated to cotton, must have been irresistible. Might the details of Turtlehead trichome development provide clues for future improvement in the production or quality of cotton fibers? A study of Turtlehead stamen hairs could possibly pay off for the cotton industry.

Here is what Piao et al. (2022) report: From myriad genes active in early growth of Turtlehead stamens, the scientists were able to isolate and identify a gene called *CgMYB4*; "*Cg*" denotes that this gene was isolated from *Chelone glabra* and "*MYB*" indicates that the gene belongs to a certain large group of genes known as transcription factors. Transcription factors are genes that regulate other genes, either activating or de-activating a gene target. Much of the paper describes a series of experiments that, collectively, support the conclusion that *CgMYB4* is, indeed, responsible for stamen hair initiation in Turtleheads, much the same way that similar *MYB* genes initiate the trichomes of Cotton ovules. Further, Piao et al. document that both the *CgMYB4* gene in *Chelone* and the *MYB* genes in Cotton are similar to *MYB* genes in Thale Cress (*Arabidopsis thaliana*) that, perhaps you guessed it, control trichome initiation. Thale Cress, by the way, is easily the most thoroughly studied plant species in terms of its genetics, cell, and molecular biology. The *MYB* genes from these three plants are similar, but not identical. And that is about it! No dramatic conclusion in *this* paper about how Turtleheads might help the cotton industry make better cotton. But that is how science works; it takes a lot of careful, detailed, effort to make small advances.

There is, however, a deeper truth revealed in this paper. Yes, Turtleheads and Cotton are very different plants, at least in terms of their external appearance. Nevertheless, as science probed the inner workings of their DNA, the molecules made by their

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Cotton & Turtlehead

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genes, and how those molecules function in their cells, broad similarities emerged between these otherwise different plants. That very different species can share fundamentally similar genetic and molecular features is an unexpected truth to have emerged from reductionist approaches to the study of biodiversity. But despite general *similarities*, these small features are not *identical*. Regardless of scale, the study of biodiversity is always about comparisons of similarities and differences between organisms. It is from the dynamic interplay of similarities and differences that our taxonomic classifications, identification keys, and tree-like diagrams depicting relationships, emerge.

Disappointingly, the Piao et al. paper is silent about how knowledge of trichome initiation in Turtleheads and other plants might have practical application, but I can think of one possibility. Cotton seeds actually make two kinds of fibers, short fuzz fibers and long lint fibers. Lint fibers are valuable for spinning into thread, but the fuzz fibers are too short for this use. Perhaps deep knowledge about the genetic control of trichome initiation in *Chelone* and other plants will someday lead to improved varieties of cotton that channel all their energy into making the long, spinnable, lint fibers. Just imagine, someday, knowledge about Turtlehead stamens could help improve the cotton in our t-shirts and blue jeans!

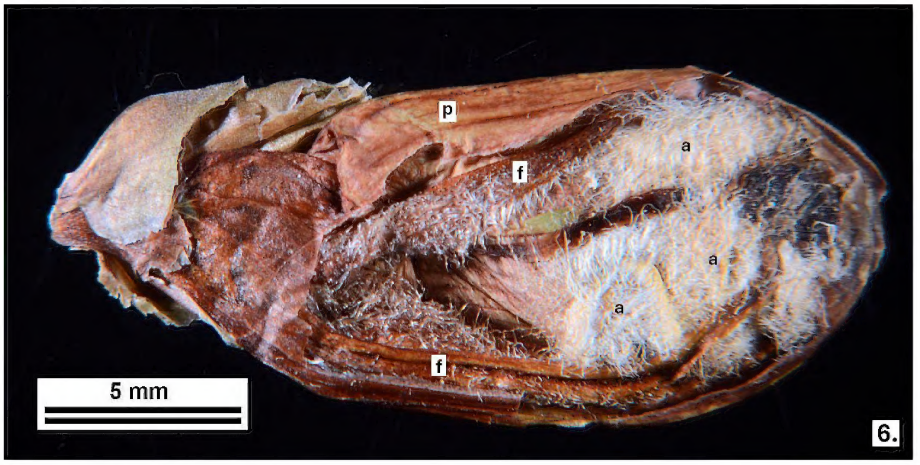

Figure 6. Chelone glabra, White Turtlehead, hairy stamens enclosed in a dissected floral bud from an herbarium specimen; a = anther, f = filament, p = petal.

LITERATURE CITED

Piao, C., Z. Gao, S Yuan, F. Li, and M-L. Cui. 2022. The R2R3-MYB gene *CgMYB4* is involved in the regulation of cell differentiation and fiber development in the stamens of *Chelone glabra* L. Protoplasma (2022): 1397-1407.

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